

**COPY**

Effective Date: 6/27/00

**MEMORANDUM OF AGREEMENT**  
**between the**  
**FEDERAL AVIATION ADMINISTRATION**  
**and the**  
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**  
**concerning**  
**Weather Accident Prevention R&D Activities**

1. **PURPOSE:** This Memorandum of Agreement (MOA) establishes a cooperative research program between the Federal Aviation Administration's (FAA) and the National Aeronautics and Space Administration's (NASA) Weather Accident Prevention R&D activities. This MOA is covered by the existing FAA-NASA Memorandum of Understanding concerning Aviation Safety Research, FNA-08.
2. **BACKGROUND:** The world-wide demand for air travel is expected to increase over the coming two decades - more than doubling by 2017. Without an improvement in the accident rate, such a traffic volume would lead to a projected 50 or more major accidents a year - a nearly weekly occurrence. Approximately 1/3 of the accidents in the 1990-1996 baseline have been attributed to adverse weather. A White House Commission on Aviation Safety and Security has called for a 80% reduction in the rate of fatal aviation accidents by the year 2007. Both FAA's Safer Skies Safety Agenda and NASA's Aviation Safety Initiative share this common national goal. In April 1997, the National Aviation Weather Program Council under the Office of the Federal Coordinator for Meteorology issued a National Aviation Weather Program Strategic Plan, which provides for an interagency focus towards improving information and tools needed to allow aviation personnel to make sound and safe decisions regarding weather hazards. In February 1999, the same Council published a National Aviation Weather Initiatives document that defined a number of achievable high impact safety initiatives. This MOA will provide and promote coordination and integration of research that create a combined R&D portfolio that contributes to meeting the common safety goals and initiatives presented in these two documents.
3. **SCOPE/OBJECTIVE:** This MOA encompasses the cooperative efforts required to develop and validate the following products in support of needs and requirements of the National Airspace System (NAS) users as established by the FAA:
  1. Aviation Weather Information Technologies for NAS and Users
  2. Aviation Weather Products
  3. Electronic Pilot Reporting/Automet Technologies
  4. Forward-Looking Weather Hazard Sensors
  5. Turbulence Controls and Mitigation Systems

Technical, safety and economics assessments of these products will be performed and be used to determine their implementation potential and continued development.

4. **STATEMENT OF WORK (SOW):** FAA and NASA will focus their efforts on defining tasks to meet the overall goals/objectives of this MOA and on ensuring a coordinated series of activities that will improve aviation safety by reducing weather-related risks. The following statement of work elements define the scope of this MOA. Copies of the FAA and NASA Program Plans are attached. These plans detail the respective multi-year R&D effort. These plans include:

FAA:

- a. Aviation Weather Research Program (AWRP) Plan

NASA:

- a. Aviation Weather Information Element Plan
- b. Weather Information Communications Element Plan
- c. Turbulence Detection and Mitigation Element Plan

A. TASKS: The FAA and NASA will jointly perform the activities listed below.

1. Develop, prototype and validate Aviation Weather Information (AWIN) Technologies that support the NAS and users and the safe and efficient operation for both high and low-end aircraft and rotorcraft. The joint development will include but not be limited to operational concepts for flight information services (FIS) and weather, FIS/weather displays (including integrated displays), communication and data link technologies and system architectures, hazard metrics, weather products, aircraft controls in adverse weather, accident analysis, AWIN system standards and operations, human error, workload and integration modeling, training and education, and advanced sensors.
2. Increase the accuracy and timeliness of aviation weather models and algorithms that lead to intuitive weather products for the NAS and users. Efforts will accelerate development of improved point, area and route-specific forecasts of weather hazards including Instrument Meteorological Conditions (IMC), Turbulence, Icing, Convective Weather, Winds/Windshear, Wake-Turbulence, Winter Weather and Volcanic Ash. These forecasts will be produced with sufficient time and spatial resolution and update rates to provide estimates of parameters such as location, time of onset, duration, probability of occurrence, and severity of the areas to aid aviation users in avoiding these hazards. Improved use of text and graphics for presentation of information to various ground and airborne users and training for the proper use of that information will also be addressed.
3. Develop, prototype and validate Electronic Pilot Reporting (E-PIREP)/Automet technologies that utilize instrumented aircraft in flight as weather observing stations that report in-situ conditions to users of that information. E-PIREPS measurements will address improved information on atmospheric quantities and hazards such as icing conditions, turbulence, water vapor, winds, and temperature. The joint development will include but not be limited to advanced sensors, communication and data link technologies and system architectures (i.e. air-ground, air-air, ground-ground, and ground-air), E-PIREP system standards and operations, human error, workload and integration modeling.
4. Develop, prototype and validate forward-looking sensor systems for turbulence and other weather hazards to detect the full category of turbulence including clear air, convective, wake-turbulence (enroute and terminal), and mountain wave, as well as other weather/atmospheric hazards including icing, wind shear/severe winds, hail, lightning, runway contamination, volcanic ash and other flight hazards. The joint development will include but not be limited to advanced sensors and algorithms, communication and data links, turbulence system standards and operations, human error, workload and integration modeling, and training and education.
5. Develop, prototype and validate turbulence mitigation techniques and technologies that will dampen the effects of turbulence and other weather hazards on aircraft occupants and critical components. The joint development will include but not be limited to refinements to control system modes, aerodynamic surfaces, and aircraft structures to reduce significant and hazardous gust-induced accelerations, control system standards and operations, and training and education.

B. RESOURCES:

Personnel - To meet that responsibility, the FAA and NASA plan to staff the project in accordance with the following profile:

## Planned Staffing (Full-Time Equivalent)

|       | FY 00 | FY 01 | FY 02 | FY 03 | FY04 | Total |
|-------|-------|-------|-------|-------|------|-------|
| FAA   | 4     | TBD   | TBD   | TBD   | TBD  | TBD   |
| NASA  | 29    | 29    | 29    | 28    | 26   | 141   |
| Total | 33    | TBD   | TBD   | TBD   | TBD  | TBD   |

**Funding:** - The FAA will be responsible for funding all the tasks and associated travel within its area of responsibility, as specified in section 4. NASA will be responsible for funding all the tasks and associated travel within its area of responsibility, as specified in section 4. The funding shown is for planning purposes only and does not constitute authority to commit, obligate or expend funds except as authorized by NASA and FAA procurement officials. FAA's (or NASA's) obligation for providing funds to NASA (or FAA), through the life of this program, is contingent upon the availability of appropriated funds. This agreement is mutually beneficial to both NASA and FAA with both agencies waiving any administrative tax for transferred funds.

## Planned Net Funding to Conduct Tasks (\$M)

|                 | FY 00   | FY 01   | FY 02   | FY 03   | FY04    | Total    |
|-----------------|---------|---------|---------|---------|---------|----------|
| FAA (in-house)  | \$17.8M | \$24.7M | \$25.1M | \$26.6M | \$27.1M | \$121.3M |
| FAA (transfer)  | \$1.4M  | \$1.3M  | \$1.2M  | \$1.1M  | \$1.1M  | \$6.1M   |
| NASA (in-house) | \$7.5M  | \$7.2M  | \$6.8M  | \$8.8M  | \$9.2M  | \$39.5M  |
| NASA (transfer) | \$2.0M  | \$2.0M  | \$2.0M  | \$2.0M  | \$2.0M  | \$10.0M  |
| Total           | \$28.7M | \$35.2M | \$35.1M | \$38.5M | \$39.4M | \$176.9M |

**Facilities:** - The R&D flight platforms and facility schedules are outlined in the attached copies of the FAA and NASA Program Plans referenced above.

- C. **SCHEDULE:** The R&D planning schedule is outlined in the attached copies of the FAA and NASA Program Plans referenced above.
- D. **REPORTS:** Technical reports generated from joint work performed under this agreement will be published, in accordance with Section 6 of this document, by the organization having primary responsibilities, with due acknowledgment and credit given to each organization's contribution. Research results and deliverables will be released through routine FAA and NASA channels.

5. **TECHNICAL REPRESENTATIVES:** The individuals listed below are responsible for the oversight of this MOA at their respective HQs and/or Centers; however, they do not have the authority to alter any of the terms of this MOA. Any requests for changes must be made in accordance with Section 8 of this document, Modification /Amendments/Termination. The central point of interagency coordination and information for this MOA is the FAA/NASA R&D Field Office at NASA, Langley Research Center, Hampton, VA.

Gloria Kulesa, FAA AUA-430, PL-100, 400 7<sup>th</sup> Street SW, Washington, DC 20591, tel: (202) 493-0108, fax: (202) 366-7022, [gloria.kulesa@faa.gov](mailto:gloria.kulesa@faa.gov)

Ron Colantonio, NASA Glenn Research Center, MS 60-5, 21000 Brookpark Road, Cleveland, OH 44135, tel: (216) 433-6370, fax: (216) 433-2645, [ron.colantonio@grc.nasa.gov](mailto:ron.colantonio@grc.nasa.gov)

6. DISSEMINATION OF INFORMATION: To the extent permitted by applicable law, initial release of any information to the public, whether oral or written, concerning results obtained or conclusions reached in the performance of this MOA, may only be made with prior written approval of the FAA and NASA Technical Representatives named in Section 5.
7. PERIOD OF PERFORMANCE: The period of performance for this research program shall commence upon the effective date of the MOA and shall remain in effect for 5 years.
8. MODIFICATION/AMENDMENTS/TERMINATION: This MOA may be modified only upon the mutual written consent of both agencies. Modifications must be signed by the authorized representatives of the FAA and NASA, or their designees. No oral statement by any person shall be interpreted as modifying or otherwise affecting the terms of this MOA.

Either agency may terminate this MOA upon 180 days written notice to the other agency, signed by the authorized representative of the terminating agency, or the designee of such representative. The notice shall reference the title and identifying number of this MOA, and shall contain the effective date of the termination. Upon termination, each agency will refund any portion of those funds that have been advanced by the other agency but not yet expended in connection with work under this MOA.

9. AUTHORITY:

A. NASA

This MOA is entered into on behalf of NASA under the authority found in §203 (c) of the National Aeronautics and Space Act of 1958, 42 U.S.C. §2473 (c).

B. DOT/FAA

This MOA is entered into on behalf of FAA under 49 U.S.C. §106 (l) (6), and (m).

C. FAA/NASA Executive Committee

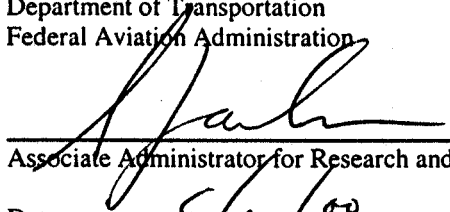
This cooperative activity is established under the agreement for cooperation between the FAA and NASA signed by the Administrators on October 9, 1998 entitled "A Partnership to Achieve Goals in Aviation and Future Space Transportation."

D. Transfer of Funds

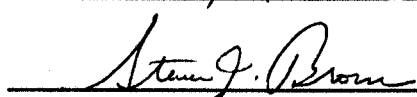
The Economy Act, 31 U.S.C. §1535, is the authority for all orders to be placed by the FAA or NASA with the other agency for goods and services to be provided on a reimbursable basis. The reimbursable agreement document is an Inter-Agency Agreement (IAA) for the FAA and a Purchase Order for NASA.

**APPROVAL:**

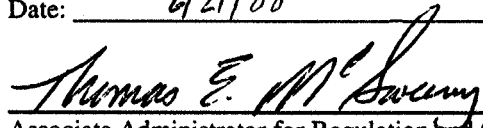
Department of Transportation  
Federal Aviation Administration

  
Associate Administrator for Research and Acquisitions

Date: 6/21/00

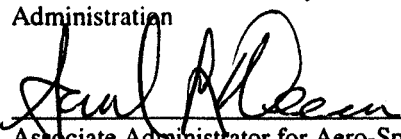
  
Associate Administrator for Air Traffic Services

Date: 6/21/00

  
Associate Administrator for Regulation and Certification

Date: 6/26/00

National Aeronautics and Space  
Administration

  
Associate Administrator for Aero-Space Technology

Date: 6/27/00